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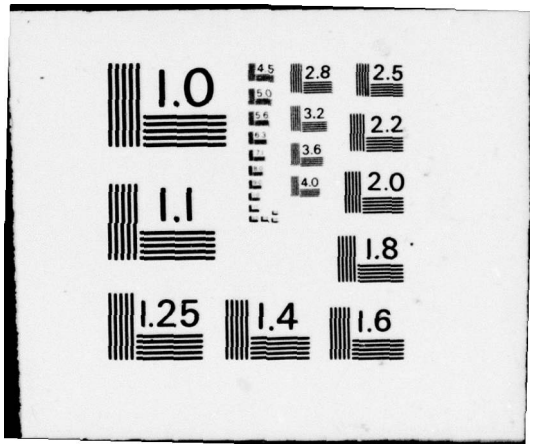
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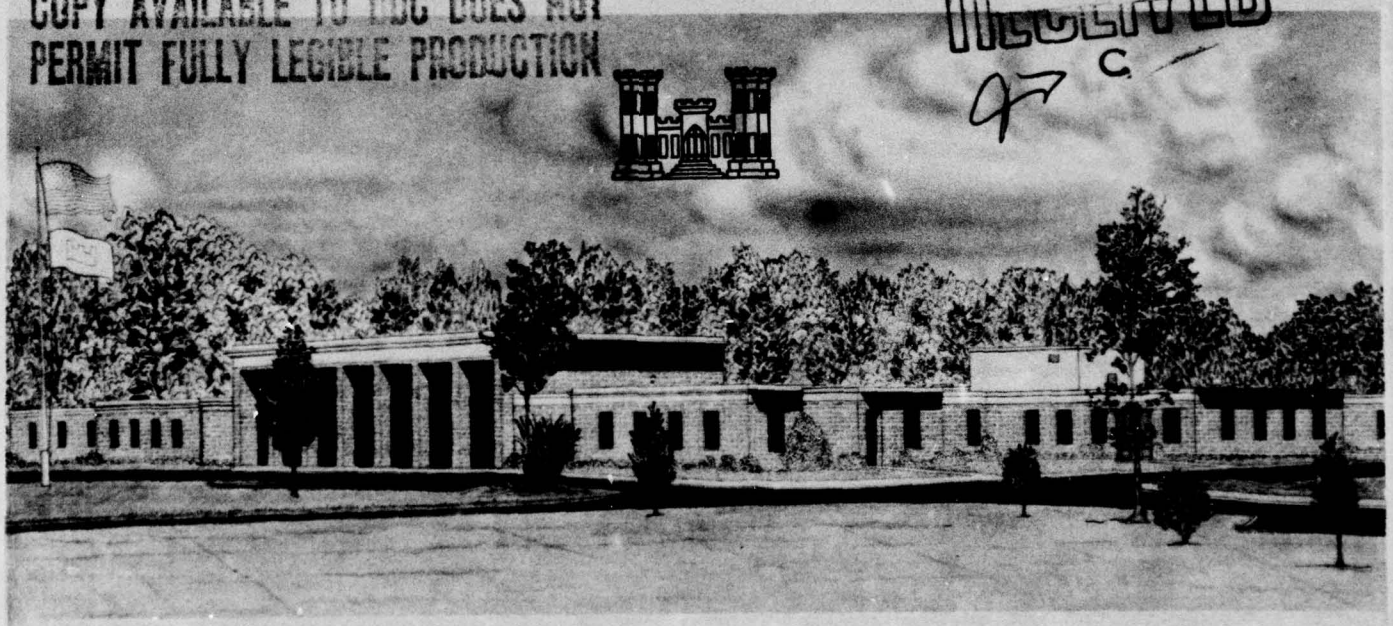
CONDITION SURVEY, FT. DEVENS ARMY AIRFIELD, FT. DEVENS, MASSACHUSETTS

by

R. D. Jackson, P. J. Vedros



June 1973

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Soils and Pavements Laboratory
Vicksburg, Mississippi

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(9) MISCELLANEOUS PAPER S-73-47

(6) CONDITION SURVEY, FT. DEVENS ARMY AIRFIELD, FT. DEVENS, MASSACHUSETTS.

by

(10) R. D. Jackson, P. J. Vedros

(11) June 1973 (12) 18 p.

Sponsored by Office, Chief of Engineers, U. S. Army

(14) WES-MP-S-73-47

Conducted by U. S. Army Engineer Waterways Experiment Station
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Foreword

Authority for conducting condition surveys at selected airfields is contained in Long-Range Program, O&M,A, FY 1973, Project Q6-1: "Engineering Criteria for Design and Construction, WES," dated 1 July 1972.

The facilities at Ft. Devens Army Airfield, Ft. Devens, Massachusetts, were inspected during August 1972 by Messrs. R. D. Jackson, P. S. McCaffrey, Jr., and W. J. McKay of the Engineering Design Criteria Branch, Soils and Pavements Laboratory, U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi. This report was prepared by Messrs. Jackson and P. J. Vedros under the general supervision of Messrs. J. P. Sale, R. G. Ahlvin, and R. L. Hutchinson of the Soils and Pavements Laboratory, WES.

COL Ernest D. Peixotto, CE, was Director of the WES during the conduct of the study and preparation of this report. Mr. F. R. Brown was Technical Director.

Contents

Conversion Factors, British to Metric Units of Measurement

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
feet	0.3048	meters
miles (U. S. statute)	1.609344	kilometers
gallons (U. S. liquid)	3.785412	cubic decimeters
pounds (mass)	0.45359237	kilograms
pounds (force) per square inch	0.6894757	newtons per square centimeter
Fahrenheit degrees	*	Celsius or Kelvin degrees

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (5/9)(F - 32) + 273.15$.

CONDITION SURVEY, FT. DEVENS ARMY AIRFIELD
FT. DEVENS, MASSACHUSETTS

Purpose

1. The purpose of this report is to present the results of an inspection performed at Ft. Devens Army Airfield (DAAF), Ft. Devens, Massachusetts, during August 1972. The inspection was limited to visual observations, and no tests were conducted on the existing runways and taxiways. A layout of the airfield is shown in plate 1.

Pertinent Background Data

General description of airfield

2. DAAF is located in Middlesex County, near the town of Ayer, Massachusetts, and lies generally south of State Highway 2A and just east of the Nashua River. Ft. Devens proper is due south of the airfield. A vicinity map is shown in plate 1.

3. The airfield is situated generally on the floodplain of the Nashua River and is surrounded by low, rounded hills. Relief in the adjacent area is approximately 200 ft.* The Ft. Devens area is underlain by Ayer granite, a coarse-grained, porphyritic, biotite-muscovite granite. The subgrade soils at the airfield site, in general, are of a sandy nature and vary from a brown sand (SP-SM**) to a gravelly sand (SP). Groundwater exists at depths greater than 30 ft and slightly above the base level of the river. Temperature and precipitation data are presented in table 1. The amounts of departure from normal for the 1972 temperatures and precipitation were determined using periods of

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* A table of factors for converting British units of measurement to metric units is presented on page vii.

** SP-SM and SP are classifications of the U. S. Department of Defense, "Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations," Military Standard MIL-STD-619B, June 1968, U. S. Government Printing Office, Washington, D. C.

record of 86 and 108 years, respectively.

4. In August 1972, the airfield consisted of a NW-SE (14-32) runway, approximately 100 ft wide and 3745 ft long; a N-S runway, 60 ft wide and 2560 ft long; two helicopter runways; four taxiways; and a parking and maintenance apron.

Previous reports

5. Previous reports pertaining to the load-carrying capabilities of the pavements at DAAF are listed below:

a. U. S. Army Engineer District, Boston, CE, "Pavement Evaluation Report, Ft. Devens Airfield, Massachusetts," November 1944, Boston, Massachusetts.

b. Ohio River Division Laboratories, CE, "Airfield Evaluation Report, Ft. Devens Army Airfield, Massachusetts," January 1968, Cincinnati, Ohio.

c. U. S. Army Engineer Division, New England, "Fort Devens Army Airfield, Supplemental Report of Pavement Evaluation," January 1970, Waltham, Massachusetts.

Pertinent data were extracted from these reports for use in this condition survey report.

History of Airfield Pavements

Construction history

6. Original construction at DAAF was completed in 1941 by the Works Progress Administration and consisted of runways that were 150 ft wide and of various lengths and a service apron with connecting taxiways. The pavement section consisted of soil cement pavement mixed in place. A tar surface seal was placed over the cured soil cement pavement. In 1942, the runways were widened to 300 ft by the Corps of Engineers with the same construction procedures as were used in the 1941 construction. Several hardstand areas were also constructed using the soil cement and tar seal. In 1944, the Navy constructed a small parking apron (400 by 75 ft) consisting of a tar surface treatment over 14 in. of gravelly sand base. The helicopter runways and parking aprons were constructed in 1958-59.

7. Taxiway D was rebuilt in 1960 by U. S. Army Engineer troops.

The old bituminous surface treatments and the gravel base were scarified and compacted. A 3-1/2-in., mixed-in-place, bituminous macadam surface was then constructed. In 1961, an engine run-up apron was constructed, which was designed for a 12,000-lb, single-wheel load with 100-psi tire pressure. A summary of physical property data is presented in table 2.

Traffic history

8. From 1941-1944, the airfield was used by the Army Air Corps. Traffic consisted of occasional operations of such aircraft as B-25's, B-26's, B-17's, C-47's, and A-29's. These were mostly transient aircraft operations and averaged about 5 operations per day. From April 1944 to the end of World War II, the Navy used the airfield for practice landings. Operations averaged about 350 per day with about 95 percent of this traffic involving single-engine aircraft with gross weights of 12,000 to 15,000 lb. The remaining 5 percent involved multiengine aircraft with gross weights of about 20,000 to 30,000 lb. Following Navy usage, no traffic records were kept until July 1952. From July 1952-December 1955, an average of about 180 cycles* per month were applied, with approximately 60 percent of these operations being on the NW-SE runway. During the period January-October 1956, the average monthly cycles of traffic were approximately 360. The major portion of the above traffic involved "L" and "H" type aircraft, with only occasional traffic of the heavier "C" and "B" type aircraft. Traffic records were not available for November 1956-December 1970. Total fixed-wing traffic for 1971 amounted to 24,838 cycles. Approximately 26 percent of this traffic had gross weights of 12,500 lb or more, carried 255 gal or more of fuel, or had the capacity for at least 11 passengers. During the period 1 January-30 June 1972, traffic in the above category amounted to 5105 cycles, 3185 rotary-wing and 1920 fixed-wing cycles. C-123 traffic amounted to 916 cycles, and C-130 traffic amounted to 899 cycles. Total aircraft traffic during the above period amounted to 17,448 cycles.

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* A cycle of operation is one takeoff and one landing.

Conditions of Pavement Surfaces

9. In August 1972, the conditions of the pavement surfaces ranged from good to excellent. The NW-SE runway had a 1-in. leveling and a 1-in. surface course applied in 1961. In 1969, a bituminous slurry seal was applied to the surface in an effort to seal the cracks that had reflected through the 2-in. overlay from the underlying soil cement. Photo 1 shows both longitudinal and transverse cracks in this runway. Most of the cracks were in the transverse direction and were spaced at 25- to 50-ft intervals. None of the cracks showed evidence of movement; however, the material on each side of some of the cracks was slightly higher than the surrounding area (photo 2). This runway was considered to be in good condition (photo 3). The N-S runway is used primarily as a taxiway and was in excellent condition (photo 4). This runway was overlaid with 1 in. of bituminous concrete in 1969. The overlay for taxiway D was specified as a nominal 2 in.; however, subsequent investigation by the New England Division indicated the overlay was actually 2.5 in. thick. Taxiways B and C have been overlaid twice since they were constructed. The first overlay was 1.5 in. of bituminous concrete and the second was 2 in. Taxiway A was overlaid in 1969 with 1 in. of bituminous concrete. The taxiways were in good to excellent condition. All of the apron areas were overlaid in 1969 with 1 to 3.5 in. of bituminous concrete. The apron areas were considered to be in excellent condition.

Evaluation

10. A summary of the basic field evaluation is presented in table 3. Table 4 presents a summary of the pavement evaluation for overload aircraft. These evaluations were made by the New [redacted]land Division and are also contained in the report listed in subparagraph 5c. The evaluation shown in table 4 for overload aircraft is for load only and does not take into account any physical limitations such as runway length, etc.

Table 1

Temperature and Precipitation Data

Month	Average 1972 Temperature, F	Departure from Normal, F	1972 Precipitation in.	Departure from Normal, in.
January	25.8	-0.1	1.80	-2.30
February	23.0	-3.7	5.23	2.02
March	31.7	-3.5	5.82	1.45
April	41.7	-5.0	3.35	-0.71
May	57.2	-1.2	5.56	1.74
June	64.9	-2.4	6.25	2.31
July	72.0	-0.3	6.15	2.69
August	68.6	-2.0	2.59	-0.66
September	62.3	-0.3	2.65	-1.46
October	47.6	-4.8	3.59	0.16
November	36.4	-4.8	7.79	3.51
December	29.1	-0.1	6.75	3.04
Annual	46.7	-2.4	57.53	11.79

Note: Lowest temperature in 1972 was 15 F on February 23; highest temperature in 1972 was 93 F on August 26.

Table 2

SUMMARY OF PHYSICAL PROPERTY DATA

FACILITY				OVERLAY PAVEMENT			PAVEMENT			BASE			SUBGRADE		GENERAL CONDITION OF AREA CONSIDERED
Fort Devens AAF, Fort Devens, Mass.															
FACILITY NUMBER AND IDENTIFICATION		LENGTH FT	WIDTH FT	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	DESCRIPTION	FLEX. STR PSI	THICK. IN.	CLASSIFICATION	CBR OR K	CLASSIFICATION	CBR OR K	
R1B	NW-SE runway ends	500	100	2	Bituminous concrete		1	Accumulated seal coats		6	Soil cement	80	Sand (SP)	24	
R2C	NW-SE runway interior	2745	100	2	Bituminous concrete		1	Accumulated seal coats		6	Soil cement	80	Sand (SP)	24	
R3B	N-S runway ends	500	60	1	Bituminous concrete		1	Accumulated seal coats		6	Soil cement	80	Sand (SP)	24	
R4C	N-S runway interior	1560	60	1	Bituminous concrete		1	Accumulated seal coats		6	Soil cement	80	Sand (SP)	24	
R5C	Helicopter runways No. 15-33 No. 2-20	 460 475	 40 40				2.5	Bituminous concrete		6	Sand and gravel	50	Sand (SP)	24	
T1C	Taxiway B	350	75	2	Bituminous concrete		1.5 0.5	Bituminous concrete Surface treatment		6	Soil cement	80	Sand (SP)	24	
T2C	Taxiway C	175	75	2	Bituminous concrete		1.5 0.5	Bituminous concrete Surface treatment		6	Soil cement	80	Sand (SP)	24	
T3C	Taxiway D	1050	50	2.5	Bituminous concrete		3.5	Bituminous macadam (mixed in place)	80	8	Gravel	25	Silty sand (SP-SM)	15	
T4C	Taxiway A	300	100				2.5	Bituminous concrete		6	Sand and gravel	50	Sand (SP)	24	
A1C	Engine run-up area	Irregular	Irregular	2	Bituminous concrete		2	Bituminous concrete		6	Stabilized aggregate	80	Sand (SP)	24	
A2C	Parking and maintenance apron	Irregular	Irregular	1.5 2	Bituminous concrete Bituminous concrete		1.5 0.5	Bituminous concrete Surface treatment		6	Soil cement	80	Sand (SP)	24	
A3C	Parking aprons	650	100	2	Bituminous concrete		3.5	Bituminous macadam (mixed in place)	80	8	Gravel	25	Silty sand (SP-SM)	15	
A4C	Parking and access apron	Irregular	Irregular	1	Bituminous concrete		2.5	Bituminous concrete		6	Graded crushed aggregate	100	Sand (SP)	24	

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Table 3

Summary of Basic Field Evaluation, August 1972

Designation	Allowable Gross Aircraft Loadings, lb			
	Normal Period Operation		Frost-Melting Period Operation	
	Single-Wheel Gear	Twin-Wheel Gear	Single-Wheel Gear	Twin-Wheel Gear
NW-SE runway	70,000	50,000+	*	*
N-S runway and taxiways B and C	55,000	50,000	*	*
Taxiway D**	34,000	47,000	30,000	37,000
Apron system	70,000+	50,000+	*	*

* Frost evaluation is same as normal period evaluation.
** Basic field evaluation.

Table 4

Summary of Pavement Evaluation for Overload Aircraft

Overload Aircraft			Allowable Gross Aircraft Load, lb		
Type Aircraft	Weight, lb		One Cycle per Day	One Cycle per Week	One Cycle per Month
	Empty	Gross			
C-123	30,000	60,000	45,000		
C-131	30,700	60,000	48,000		
C-119	41,000	77,000	48,000		
C-54	39,000	82,500	48,000		
C-130	69,837	155,000	105,000	125,000	
C-124	100,000	216,000	130,000	190,000	

Aircraft can operate at maximum gross load.

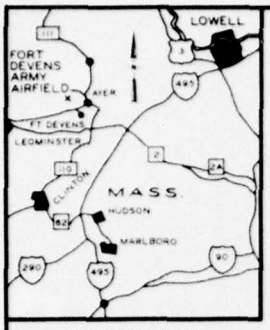
45,000 Aircraft can operate at indicated gross load.

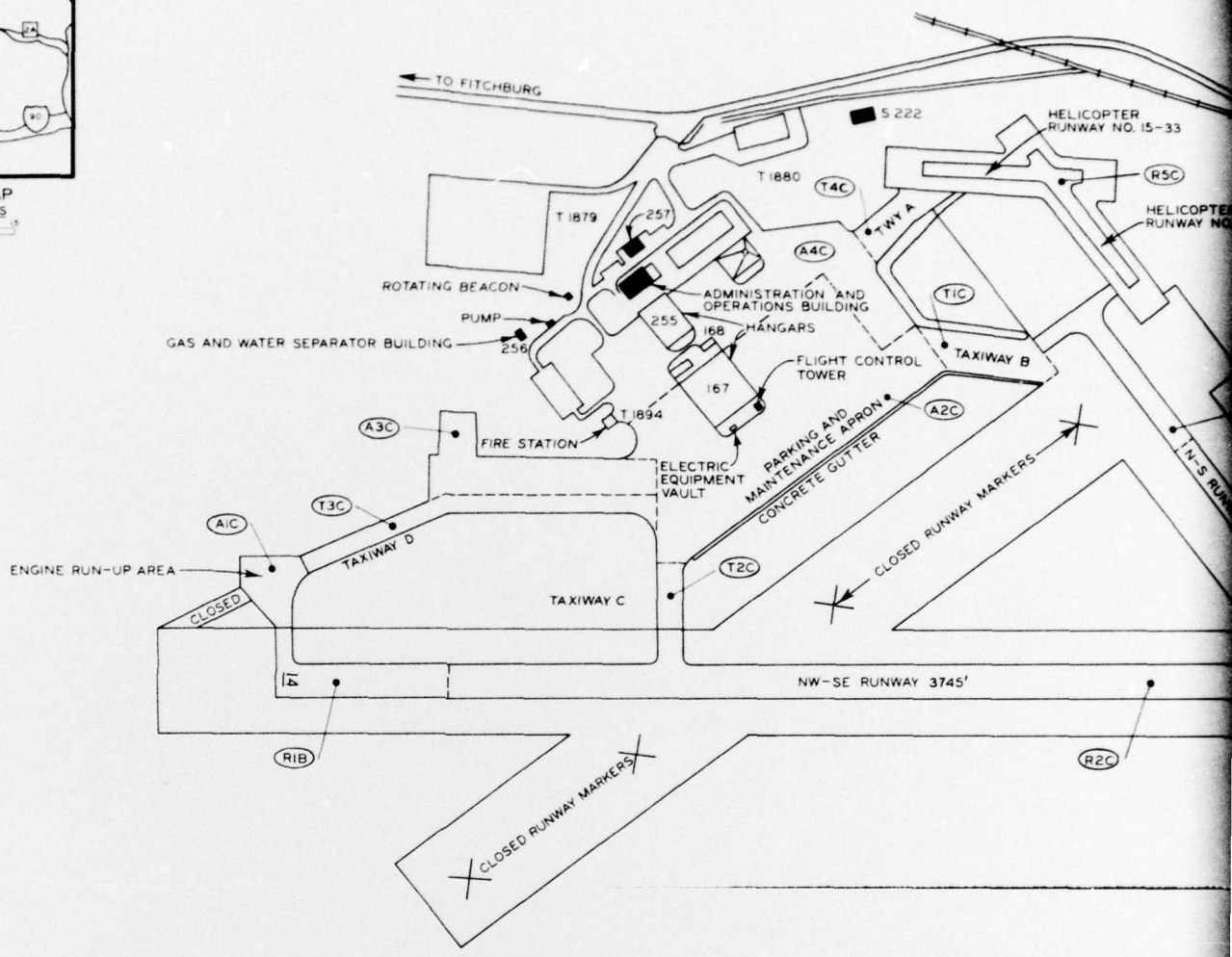
Photo 1. Longitudinal and transverse cracks in NW-SE runway

Photo 2. Cracks with slightly raised edges on NW-SE runway

Photo 3. General view of NW-SE runway

Photo 4. General view of N-S runway





LEGEND

(R1B) FEATURE DESIGNATION (SEE NOTE 1)

TYPE OF FEATURE

R - RUNWAY
T - TAXIWAY
A - APRON

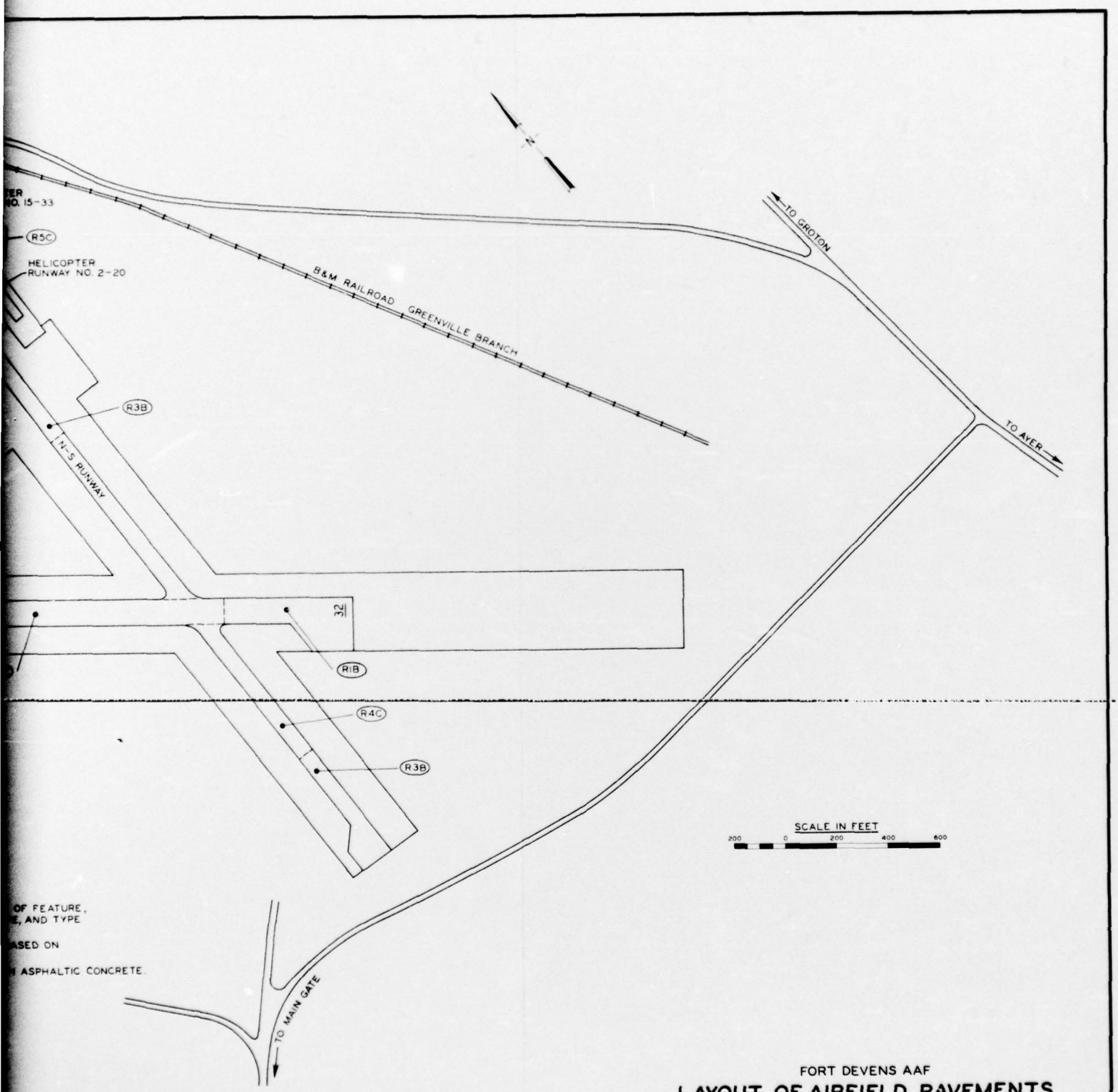
TYPE TRAFFIC AREA (SEE NOTE 2)

B - B TYPE TRAFFIC
C - C TYPE TRAFFIC

NOTES: 1. FEATURE DESIGNATION DENOTES TYPE OF FEATURE, NUMBER OF FEATURE FOR GIVEN TYPE, AND TYPE OF TRAFFIC AREA.

2. TRAFFIC AREA DESIGNATIONS ARE BASED ON LIGHT-LOAD CRITERIA.

3. ALL PAVEMENTS ARE SURFACED WITH ASPHALTIC CO



FORT DEVENS AAF

LAYOUT OF AIRFIELD PAVEMENTS

PLATE 1

2